

Synecological and Biogeographical Outlines of Lepidoptera Communities in North Korea

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Abstract For a synecological and the biogeographical outlines of the North Korean Lepidoptera, the structure of Lepidoptera communities was investigated in 5 main plant formations of lowland and montane zones. Of these, 51 species are recorded new for Korean fauna. The montane larch-spruce taiga in Mt. Paektu-san and the lowland Sasamorpho-oak forest in Mt. Kumgang-san seem to be the most characteristic and unique in Korean Peninsula.

Key words Lepidoptera, communities, synecology, biogeography, North Korea.

INTRODUCTUION

Faunal inventory of the Korean Lepidoptera has a long history of research which had been conducted from the late of 1880' by some European and Japanese entomologists (e.g. Fixsen, 1887; Leech, 1887, 1888, 1889; Herz, 1904; Matsumura, 1926-27; Inoue, 1946; Bryk, 1946, 1949; Witt, 1980, 1985; Ronkay, 1982; Sugi, 1982; Schintlmeister, 1989; Arenberger, 1991) before some Korean earlier workers started to explore it (Seok, 1934; Seok & Wang, 1938; Kim, 1976)—for review, see Park and his cooperators (1976-1991). But with respect to the comprehensive faunistic research, a basic synecological study of Korean Lepidoptera and their association with climax habitats is badly needed.

The aims of our joint paper is (1) to provide new data on the relationships between selected plant communities and most characteristic species of Lepidoptera, (2) to record new faunistic data from northern Korea and discuss their biogeographical and ecological importance. Such explorations and basic research are urgent for the northern territory of Korea especially (c.f. Razowski, 1989; Mahunka, 1991). Strictly synecological approach to Lepidoptera seems to be exceptional in the East Palaearctic generally (cf. Kuznetsov, 1967; Thistjakov, 1984; Kononenko, 1986).

Biogeographical feature of North Korea

Geological characteristics: In its geological structure Korea is predominantly a part of East Asian continent. The prevalence of crystalline schists and granite, which together cover much more than half of Korean surface, and the almost complete lack of active volcanos link it with southeastern Manchuria and Shandong peninsula, but distinguish it from the Japanese islands. There are close relationships between northern and southeastern Manchuria in the trend of the crystalline schists, the stratigraphy of the surface rocks and the significance of recent basalt flows. The stratigraphy of the extreme northeast, which is encircled by the River Duman-gang, is related to the eastern Manchuria and the southern Ussuri region (Lautensach, 1988).

Climate: In winter there are cold air masses originated from the north; in summer they are warm and come from the south. For this reason, Korea has extraordinarily great seasonal temperature contrasts. They are much greater than the average for the geographical latitude. Sea currents also play an important role in controlling the climate. The cold current, Oyashio, passes the coast of the Ussuri region and then southwesterly off the coast of northern Korea. A branch of the warm high saline current, Kuroshio, comes from the southwest. The mean climate of northern Korea is definitely a transition zone between the continental and the maritime spheres. The minimum January temperatures are extremely low in the north (from -30°C to -40°C). The mean maximum temperatures are around $24-29^{\circ}\text{C}$ in July. In most areas of Korea April brings the last frost. The mean temperatures of January and July are presented on Fig. 7 and Fig. 8. Precipitation increases from the coast toward the interior. The precipitation tends to be minimum in December-January or February, and maximum in July or August (Fig. 6). The average of January in the extreme northeast is less than 5mm, whereas Mt. Kumgang-san has the highest of precipitation in annual average (1,755mm). There are two types of the seasonal precipitation cycles in northern Korea; 1). small minimum and moderate maximum (most of northern Korea and entire central Korean west coast), 2). small minimum and large maximum (neck of the peninsula). Extratropical cyclones are the most regulating factors to bring rain in Korea with an average of 106 rainy days per year. Northeastern Korea which lies in the rain shadow of the main Korean Range, receives relatively little rain in all seasons. Korea has a summer corresponding to that of the perennial climate of the tropical rainforests, and a winter that is similar to Siberia in the extreme north (Lautensach, 1988).

Flora: Growing season in northern Korea lasts 28–32 weeks. Northern Korea lies in the temperate zone and does not differ fundamentally in its flora and vegetation from the other parts of the Holarctic plant Kingdom. Flora of Korea consists of a large number of Tracheophyta species—more than 3000 species of 199 families. This is due to the fact that Korea was free of inland ice during the Ice Age (Hofmann, 1913; Wilosn, 1918 in Lautensach, 1988). During the Ice Age Korea was connected with the continent on the north and the west as well. It is separated from Japan by a fairly narrow strait that was probably much narrower or which may have even disappeared during Ice Age. As a consequence, there is little floral and faunal endemism. Most Korean plants are common also in Manchuria and the Ussuri region, (e. g. *Populus maximowiczii* Henry, *Tilia amurensis* Kom., *Phellodendron amurense* Rupr., *Sorbus amurensis* Koehne, *Betula schmidtii* Regel, *Quercus mongolica*

Fisch., *Acer mandschuricum* Max., *Acer triflorum*, Kom., *Fraxinus mandshurica* Rupr., *Juglans mandshurica* Max., *Betula dahurica* Pallas, *Alnus sibirica* Fisch., *Alnus hirsuta* Turcz.), northern China or the Japanese islands (of the Korean species, about 60% also occur in Japan). Most of plants are eurythermic in both its winter and its summer requirements and thus extends from the Japanese islands through the summer requirements and thus extends from Japanese islands through the lower elevations in northern Korea and into Manchuria — for example *Prunus strrutata* Lindl., *Pyrus ussuriensis* Max., *Rhus javanica* L., *Quercus dentata* Thunb., *Q. serrata* Thunb., *Acer pseudosieboldianum* Kom., *Fraxinus rhynchophylla* Hance, *Pinus densiflora* Sieb. et Zucc. Another group of trees makes slight demands on the temperature but do not tolerate great heat and dryness, and are therefore found only in the higher altitudinal zones. The individual species have an upper and lower limit, specific at differing altitudes. These include the maples *Acer tegmentosum* Max., *A. ukurunduense* Trautv. et Mey., *A. babinerve* Max. (extend from 500m to 1500m), *Abies holophylla* Max., *Pinus koraiensis* Sieb. et Zucc. (the lower limit drops from 1200m on Kaji-san in the south to 700m at Paektu-san in the north, and upper limit lies approx. 1900m in the south and 1700m in the north), *Abies holophylla* Max., *Picea jezoensis* Carr. and *Picea koraiensis* Nak. (from 700m to 2050m) and *Larix olgensis* Henry. Some of the tree-species, those extending into Korea from the north or those common only at higher altitudes have the tendency to advance southward or downward—*Populus davidiana* Schneid., *Alnus hirsuta* Turcz., *Betula dahurica* Pall., *B. ermanii* Cham., *Pinus pumila* Reg., *Abies nephrolepis* Maxim., *Picea jezoensis* Carrieye and *P. koraiensis* Nak. Their counterparts, which strive to advance northward or upward are : *Pinus densiflora* Sieb. et Zucc., *Carpinus laxiflora* Bl. and *Fraxinus rhynchophylla* Hance.

METHODS AND DESCRIPTION OF LOCALITIES

1. **Methods** : Lepidoptera were repeatedly collected from various plant associations in May, June, July, August, 1985–1990 by light-trapping, individual collecting of adults and larvae (Fig. 5). Larvae were reared on food plants and determinations were made by adult specimens. Flora and environment of every site were described.

2. **Characteristics of localities investigated** : The studies were carried out in 5 main localities with characteristic plant associations.

Association 1. Sasamorpha-oak forest (virgin forest) : Okryu Valley, Mt. Kumgang-san. (Fig. 3–4)

Mt. Kumgang-san is a national reserve (38° 40'N, 128° 15'E; altitude about 200m above sea level). The crystalline schists and granites are typical. Brown forest soils are most common for the locality where Lepidoptera were mainly collected. Mean character of climate is presented on Walter's climatediagram (Figs. 9~13). Characteristic flora which expresses the most typical plant community of the investigated site seems to be of a southern type with some evergreens like bamboo, *Sasamorpha*

gracilis Nak.

The most common phanerophytes are followings (numbers in the parenthesis mean coverages of the species (J. Lepa, unpublished data, July, 1990).

In tree form : *Quercus serrata* Thunb. (3), *Q. acutissima* Corr. (2), *Q. mongolica* Fisch. (2), *Pinus densiflora* Sieb. et Zucc (2), *Acer mono* Maxim. (2), *Fraxinus mandshurica* Rupr (2), *Prunus leveilleana* Koehne (2), and *Kalopanax septemlobum* (Thunb.) (1).

In shrubs : *Acer pseudosieboldianum* Kom. (2), *Acer mono* Maxim. (2), *Staphylea bumalda* D.C. (3), *Quercus mongolica* Fisch. (2), *Q. serrata* Thunb. (1), *Q. acutissima* Carr. (1), *Styrax obassia* Sieb. et Zucc. (2), *Benzoin obtusilobum* (Bl.) Kunz (2), *Carpinus cordata* Bl. (2), *Tilia amurensis* Rupe. (2), *Corylus mandshurica* Maxim. (1), *Rhus trichocarpa* Mig. (1), *Rhododendron schlippebachii* Maxim. (1), *Magnolia sieboldii* K. Koch (1), *Fatsia japonica* (Thunb.) (1), and *Actinidia arguta* (Sieb et Zucc) (1).

In herbs form : *Sasamorpha gracilis* Nak. (4), *Caecalia krameri* Mats. (2), *Boehmeria tricuspidis* (Hanse) Makino (1), *Ainsliaea acerifolia* Sch.-Bip. (1), *Rubia akane* Nak. (1), *Thalictrum* sp. (1), *Commelina communis* L. (2), and *Clematis davidiana* Schneid (1).

Association 2. Climax oak forest (virgin forest) : Pagyon-pokpo, Kaesong district.

Pagyon national reserve (38° 10' N, 126° 30'E) is a small mountain (about 200km, more than 700 m above sea level) which consists from granite gneisses and metamorphic schists. Mean lasting precipitation data is presented on Walter's climatediagram (Fig. 10).

The most common phanerophytes are followings : *Quercus dentata* Thunb., *Q. mongolica* Fisch., *Q. serrata* Thunb.—oaks are the dominant trees, *Prunus yedoensis* Matsum., *Rhus chinensis* Mill., *Populus davidiana* Dode, *Ulmus propinqua* Koida., *U. davidiana* Planch., *Acer mono* Maxim., *A. pseudosieboldianum* Kom., *Fagaria schinifolia* Sieb. et Zucc., *Rhododendron schippenbachii* Maxim., *Spiraea prunifolia* Sieb. et Zucc., *Ligustrum obtusifolium* Sieb et Zucc., *Zelkova serrata* (Thunb.) Mak., *Schizandra chinensis* (Turz.) Baill., *Niellia uekii* Nak., *Maackia amurensis* Rupr. et Maxim., *Phellodendron amurense* Rupr, and *Micromela alnifolia* Koehne. There are many woody lianas : *Clematis patens* Morr. et Decne, *Lonicera japonica* Thunb., *Pueraria lobata* (Willd.) Ohwi, *Smilax china* L., *Celastrus orbiculatus* Thunb., *Actinidia arguta* Planch., *Vitis amurensis* Rupr., *Rubus crataegifolius* Bunge. Common herbaceous plants: *Lilium concolor* Salish., *Rubia cordifolia* L., *Aristolochia contortata* Bunge, *Artemisia annua* L., *A. missouriensis* Bess, *Hypericum ascyron* L., and *Hemerocallis fulva* L.

Most of Lepidoptera were collected near Pagyon-pokpo.

Association 3. Climax oak forest (degraded by human activities) : Mt. Ryongak-san, Taedong-gang basin.

Mt. Ryongak-san is one of many typical hills (about 150–250 m above the sea level) situated in west direction from Pyongyang city (39° 00'N, 125° 35'E). The hill is composed of the metamorphic sediments of the Pyongwon massif, particularly of sandstone. Here and there are islands of granite gneiss. Wide neighborhood of Mt. Ryongak-san is covered by the fields, where mainly rice, corn, soya and cabbage are grown. Second growths of predominately deciduous oak forest are on this hill. Mean

lasting precipitation is presented on Walter's climatediagram (Fig. 11).

The Ryongak-san flora is not so rich in species in comparison with that of Pagyon natural reserve. In spite of that there are the same dominant phanerophytes and herbaceous plants. In addition to them two coniferous trees can be mentioned : *Pinus densiflora* Sieb. et Zucc. and *Juniperus rigida* Sieb. et Zucc.

Association 4. Climax maple mixed forest : Hyangsan, Mt. Myohyang-san

Hyangsan (40° 05'N, 126° 12'E) is a town situated in valley of the Chongchong-gang river (about 400m above sea level) on the foot of Mt. Myohyang, which creates boundary between two stratigraphic regions : Pyong-nam fold Belt and Western Kaema-Pyong-buk massif (in a sense Kobayashi 1941, 1942, after Lautensach., 1988). It consists of gray granite gneisses theat strike in the west-southwest to east-northeast direction. There are highly metamorphic rocks of varying petrographical nature. They are intruded by granite that is presumably quite young. where the mixed forest of the lower and medium elevations has been preserved, and a brown forest soil predominantes. Mean lasting precipitation is presented on Walter's climatediagram (Fig. 12).,

The dominant phanerophyters and linas are followings : *Acer mono* Maxim., *A. ginnala* Maxim., *A. pseudosieboldianum* Kom., *A. barvinerve* Maxim., *A. tegmentosum* Maxim., *A. ukurunduense* Trautv. et Mey., *Ulmus laciniata* May., *U. propinqua* Koidz., *Quercus monogolica*, Fisch. *Q. dentata* Thunb., *Quercus acutissima* Carr., *Castanea crenata* Sieb. et Zucc., *Pinus densiflora* Sieb. et Zucc., *P. koraiensis* Sieb. et Zucc., *Abies nephrolipis* Maxim., *A. holophylla* Maxim., *Magnalia sieboldii* K. Koch, *Rhododendron mucronulatum* Turcz., *R. schlippenbachii* Maxim., *Styrax obassia* Sieb. et Zucc., *Actinidia arguta* (Sieb. et Zucc.) Planch., *Fagara schinifolia* Engl., *Acathopanax chiisanense* Nak., *Aralia elata* Seem., *Vitis amurensis* Rupr., and *Staphylaea bumalda* D.C. The most common herbaceous plants are : *Aster scaber* Thunb., *Adenophora remotiflora* Miq., *Plantageo adiatatica* L., *Artemisia asiatica* Nak., *Astilbe chinensis* Franch. et Savat., *Asarum heterotropoides* Maek., *Sorbaria stellipila* Schneid., *Dlematis chiisanensis* Nak., and *Sanicula chinensis* Bung.

Asociation 5. Montane larch-spruce taiga : Samjiyon, Mt. Paektu-san (Fig. 1-2).

In eastern Kaema Plateau and Mt. Paektu-san region, late Tertiary and Qarternary extrusive ba-salts predominate. Acidic and basic eruptions alternated many times and covered up most of the ancient bedrock. In the southern part of this region Archeozoic rocks are widely distributed. Here meta-morphic limestones play an important role, along with mica schist and amphibolite (Lautensach, 1988). Podzoic soils are widely distributed in taiga, brown montain soils are rare. A climate is extremely cold with frequent snowfall in mid winter and not very warm in summer. The island regions along the upper Rivers Aplok-gang and Tuman-gang as well as Kaema Plateau are areas with conspicuously low precipitation (Fig. 13).

Main collection for Lepidoptera was made in Samjiyon (41° 52'N, 128° 23'E) and in Mupong-gu (42° N, 128° 35'E), about 1400m above sea level.

The larch *Larix olgensis* Henry is the most abundant tree in mountain open taiga. Very common trees on this altitude are : *Abies nephrolepis* Maxim., *Picea koraiensis* Nak., *Pinus koraiensis* Sieb. et

Zucc., *Betula ermanii* Chamisso, *Malus baccata* Borkh., *M. sieboldi* Koch., *Sorbus amurensis* Koeh., *Prunus padus* L., *Corylus heterophylla* Fisch., *Acer tegmentosum* Maxim., *A. ginnala* Maxim., *A. tschonoskii* Maxim., *A. ukurunduensis* Taut. et Mey. A shrubs layer is extraordinarily rich: *Lonicera coerulea* L., *L. chrysantha* Turcz., *Euonymus pauciflora* Rupr., *Rosa dahurica* Pall, *R. marretii* Leveille, *Dasiphora fruticosa* Rydb., *Ledum palustre* L., *Vaccinium uliginosum* L., *V. vitis-idaea* L., *Rhododendron parvifolium* Adans., *Acanthopanax sessiliflorum* Seeman, *Syringa robusta* Nak., *Spiraea salicifolia* L., *S. media* Schneid., *Rubus idaeus* L. and liana *Tripterygium regelii* Spar. et Takeda. The most common herbaceous plants are followings: *Thalictrum thunbergii* DC., *Veratrum nigrum* L., *Sanaquisorba* sp., *Lilium distychnum* Nak., *Hypericum ascyron* L., *Majanthemum bifolium* DC., *Pirola japonica* Klenze and *Linnaea borealis* L.

Very characteristics are montane Sphagnum-peat-bogs with poor and typical flora. The most common phanerophytes of the peaty-soils are *Picea koraiensis*, *Betula ermanii*, *Ledum palustre*, *Vaccinium uliginosum* and many herbaceous plants such as *Veratrum nigrum*, *Pirola japonica*, and *Linnaea borealis*.

RESULTS

1. Most characteristic bioindicator species in the investigated sites.

Species marked by asterisk (*) are the best bioindicators for an association-recorded from a particular ecosystem only.

1). Sasamorpha-oak forest : Mt. Kumgang-san, Okryu Valley.

Oecophoridae: **Casmara agronoma* Meyr.

Tortricidae: **Archips subrufannus* (Snell.), **Tosirips perpulchranus* (Kenn.), **Homonopsis foederatana* (Kenn.), **Cnephasia ussurica* Fil., **Stenopteron stenoptera* (Fil.), **Spatalistis egesta* Rax., **Hedya perspicuana* (Kenn.), **Ancylis partitana* (Christ.), **A. ampulimacula* Fikv., *A. mandariana* Wlsm., *Rhopalovalva pulchra* (Btl.), *Epinotia bicolor* (Wlsm.), *Eucosma nipponica* Kawabe, *Semnostola magnifisa* (Kuzn.).

Limacodidae: **Microleon longipalpis* Btl., *Monema flavescens* Wlk., *Latoia sinica* (Moore), *L. consocia* (Wlk.).

Thyrididae: *Rhodoneura vittula* Gn., *Strigina fixseni* Alph.

Pyralidae: *Crmbus virgatellus* Wlk., **Ancylolomia japonica* Zell. *Crambus pseudargyrophorus* Okano, *Pseudargyria interruptella* (Wlk.) *Tyspanodes hypsalis* Warren, **Pycnarmon lactiferalis* (Wlk.), *Cataprosopus monstrosus* Btl., **Sybrida approximatis* (Leech), *Orybina regalis* (Leech).

Pterophoridae: **Fuscoptilia jarosi* Arenberger.

Drepanidae: **Auzata superba* (Btl.).

Thyatiridae: *Tethea commifera* Warren.

Geometridae: **Timandromorpha discolor* (Warren), **Geometra dieckmanni* Graes., *Comibaena nigromacularia* (Leech), **Problepsis superans* (Btl.), *Tyloptera bella* (Btl.), *Calleulype whitelyi* (Btl.),

Callygris compositata (Gn.), *Eulithis fabiolaria* (Ober.), **Xaandrames dhalaria* (Moore), *Zethenia rufescentaria* Motsch., **Z. albonotaria* (Brem.), *Corymica specularia* (Moore), *Ourapteryx subpunctaria* Leech.

Epiplemae : *Epiplema moza* (Btl.).

Callidulidae : *Pterodecta felderi* (Brem.).

Lasiocampidae : **Dendrolimus spectabilis* (Btl.), **Paralebeda plagifera* Wlk.

Brahmeidae : **Brahmaea certhia* (F.), **B. tancrei* Aust.

Sphingidae : **Acosmerix nag* (Moore), *Marumba maackii* (Brem.).

Notodontidae : **Dicranura tsvetae* Schintl. & Sviridov, **Nerice leechi* Stgr., *Dudusa sphingiformis* Moore, **Spatalia plusiotis* (Ober.), **Mimopydna pallida* (Btl.).

Lymantriae : **Numenes disparilis* Stgr., **N. albofascia* (Leech), **Lymantria mathura* Moore, *Calliteara lunulata* (Btl.).

Arctiidae : *Mitochrista pulchra* tl., *M. striata* (Br. & Gr.), *Callimopha histrio* (Wlk.), **Spilosoma subcarnueum* Wlk.

Nolidae : *Meganola gigas* (Btl.).

Noctuidae : *Anacronicta caliginea* (Btl.), *Trisuloides cornelia* (Stgr.), **Trichosea champa* (Moore), *Acrionicta major* (Brem.), **Craniophora jankowskii* (Ober.), *Stenoloba jankowskii* (Ober.), **Diarsia ruficauda* (Warren), **Naenia contaminate* (Wlk.), *Sineugraphe exusta* (Btl.), *S. Bipartita* (Graes.), *Mythimna diavergens* Btl., *amphipyra schrenckii* Mén., *A. erebina* Btl., *Karana laetevirens* (Ober.), *Phylogopha beatrix* (Btl.), *Cosmia trapezina* (L.), *C. unicolor* (Stgr.), *C. camptostigma* (Mén), *Callopietria albolineola* (Graws.) *C. repleta* (Stgr.), *C. camptostigma* (Mén) *Callpiostria albolineola* (Graes.) *C. repleta* Wlk., **C. placodoides* (Gn.), *Balsa leodura* (Str.) i, *Hyposada brunnea* (Leech), *Sinochais korbæ* Püngl., *ctenoplusia albostrata* (Br. & Gr.), **Diachrysia chryson* (Esp.), *Anadevidia hebetat* (Btl.), *Catocala streckeri* Stgr. **C. lara* Brem., **Dysgonia maturata* (Wlk.), *Hypocala subsatura* Gn.

Satyridae : *Lethe diana* (Btl.).

Hesperiidae : **Carteocephalus dieckmanni* Graes.

2). Climax oak forest (virgin forest) : Pagyon-pokpo, Kaesong.

Tortricidae : **Phalondia curvistrigana* (Stt.), **Archips breviplicana* Wlsm., *Archips nigricaudanus* (Wlsm.), **Gnorismoneura mesotoma* (Yasuda), *Groesia leechi* (Wlsm.), **Acleris japonica* (Wlsm.), *Pseudohedya cincinna* (Flkv.), **Apotomis lactefascies* (Wlsm.), **Olethreutes nigricrista* Kuzn., **Rhopalovalva pulchra* (Btl.), *Epinotia bicolor* (Wlsm.).

Zygaenidae : *Chalcosia remota* (Wlk.).

Limacodidae : **Phlossa conjuncta* (Wlk.), *Latoia sinica* (Moore).

Thyrididae : *Rhodoneura vittula* Gn., **R. pallida* (Btl.).

Pyrilidae : *Pseudargyria interuuptella* (Wlk.), *Tyspanoes hypsalis* Warren, *Orybina regalis* (Leech).

Geometridae : *Naxa seriaria* (Motsch.), *Tyloptera bella* (Btl.), **Eupitheica gihgantea* Stgr., **Heterostegane hyriaria* Warren, *Ninodes splendens* (Btl.), *Obedia tigrata* (Gn.), **Biston thoracicaria*

(Ober.) *Thinopteryx defectans* (Btl.)

Epiplemae : *Epiplema moza* (Btl.).

Callidulidae : *Pterodeca felderi* (Brem.).

Sphingidae : **Smerinthus planus* Wlk.

Notodontidae : **Zaranga pannosa* Moore, *Dudusa spahingofmis*, Moore.

Arctiidae : *Callimorpha histrio* (Wlk.).

Noctuidae : *Stenoloba Jankowskii* ((Ober.), *Cosmia camptostigma* (Mén.), *Ctenoplusia albostrata* (Br. & Gr.) **Catocala separans* Leech, **Arcte coerulea* (Gn.).

Satyridae : **Ninguta schrenckii* (Mén.).

3). Climax oak forest (degraded by human activities) : Mt. Ryongak-san

Tortricidae : *Spatalistis christophana* (Wlsm.), *Rhopalovalva pulchra* (Btl.), *Eucosma nipponica* Kawabe.

Limacodidae : *Latoia consocia* (Wlk.).

Thyrididae : *Strigina cacellata* (Christ.), *Rhodoneura vittula* Gn., **R. erecta* (Leech)

Pyralidae : *Euchromius expansus* (Btl.), *Microchilo inoue* Okano, *Crambus virgatellus* Vil.

Uraniidae : **Acropteris iphiata* (Gn.).

Gemetridae : *Callygris compositata* (Gn.), *Eulithis ledereri* (Brem.), **Paratophyga hyalinata* (Kollar.), *Niodes splendens* (Btl.), **Cystidia couaggaria* (Gn.), *Obeidia tigrata* (Gn.), *Zethenia rufescentaria* Motsch., *Eulicrinia wehrlii* Djak., *Corymica specularia* (Moore), *Thinopteryx delectans* (Btl.).

Epicopeidae : *Epicopeia mencia* Moore.

Noctuidae : *Anacronicta caliginea* (Btl.), *Sineugraphe exusta* (Btl.) *S. disgnosta* (Bopursin), *Orthogonia sera* Feld., *Balsa leodura* (Stgr.), *Sphragifera biplaga* (Wlk.), *Gabala argentata* Btl., **Aonta bicolora* Leech. **Catocala actaea* Feld., & Rog.

Nymphalidae : **Neptis phillyroides* Stgr., **Hestina assimilis* (L.), **H. japonica* (C. & R. Felder).

Hesperiidae : **Leptolina unicolor* (Br. & Gr.).

4). Climax maple mixed forest : Mt. Myohyang-san

Tortricidae : **Stenodes triangulifera* Kuzn., **Archips capsigeranus* (Kenn.), **A. dichotoma* Flkv., *A. viola* Flkv., *A. nigricaudanus* (Wlsm.) **Choristoneura evanidana* (Kenn.), *Tosirips perpulchranus* (Kenn.), **Homonopsis illotana* (Kenn.), **H. rubens* Kuzn., **Ptycholoma imitator* (Wlsm.), **P. micantans* (Kenn.), *Eana argentana* (Cl.), *Spatalistis egesta* Rax., *S. christophana* (Wlsm.), *Croesia askoldana* (Christ.), *C. leechi* (Wlsm.), **Acleris lacordairana* (Dup.), *Hedya semiassana* (Kenn.), *Pseudohedya cincta* Flkv., *Epinotia bicolor* (Wlsm.), *Semnostola magnifisa* (Kuzn.).

Zygaenidae : *Chalcusia remota* (Wlk.).

Limacodidae : *Monema flavescens* Wlk., *Latoia sinica* (Moore), *L. consocia* (Wlk.).

Thyrididae : **Rhodoneura shini* Park & Byun, *Strigina cancellata* (Christ.), *S. fixseni* Alph.

Pyralidae : *Euchromius expansus* (Btl.), *Microchilo inoue* Okano, *Crambus pseudargyrophorus*

Okano, *Pseudargyria interruptella* (Wlk.), *Cataprosopus monstrosus* Btl., *Orybina regalis* (Leech).

Thyatiridae : *Tethea commifera* Warren.

Gemetridea : *Naxa seriaria* (Motsch.), **Geometra ussuriensis* (Sauber), *Comibaina nigromacularia* (Leech), *Xanthorhoe abraxina* (Btl.), *Tyloptera bella* (Btl.), *Calleulype whitelyi* (Btl.), **Callygris compositiatata* (Gn.), *Eulithis ledereri* (Brem.), **Gadaritis agnes* (Btl.), *Eulithis fabiolaria* (Ober.), **Euristophia cumulata* (Christ.), *Obeidia tigrata* (Gn.), **Ophthalmitis albosignaria* (Br. & Gr.), **Biston regalis* (Moore), **Planociampa antipala* Prout, **Proteostrenia leda* (Btl.), **Zanclidia testace* (Btl.), *Eulicrinia wherilli* Djak., *Ourapteryx subpunctaria* Leech, **Tristrophis veneris* (Btl.),

Callidulidae : *Pterosdecta felderi* (Brem.).

Bombycidae : **Ombyx mandarina* Moore.

Saturniidae : **Aglia tau* (L.).

Notodotidae : *Dudusa sphingiformis* Moore, **Hagapteryx kishidai* Nakamura.

Lymantriidae : *Callitera lunulata* (Btl.).

Arctiidae : *Mitochrista striata* (Br. & Gr.), **Bizone hamata* Wlk.

Nolidae : *Meganola gigas* (Btl.).

Noctuidae : **Cymatophoropsis trimavulata* (Brem.), *Xanthomantis cornelia* (Stgr.), *Acronicta major* (Brem.), *Stenoloba jankowskii* (Ober.), **Ochropleura triangularis* Moore, **Noctua undosa* (Graes.), *Anaplectoides virens* (Btl.), **Xestia efflorescens* (Btl.), **Sineugraphe longipennis* (Boursin), *S. exusta* (Btl.), *S. disgnosta* (Boursin), *Mythimna divergens* (Btl.), *Amphipyra schrenckii* Mén., *Orthogonia sera* Feld., *Karana laetevires* (Ober.), *Phlogophora beatrix* Btl., **Cosmia achatina* Btl., *C. exigua* (Btl.), *C. uniolor* (Stgr.), *C. camptostigma* (Mén.), **C. restituta* (Wlk.), *Dimorphicosmia variegata* (Ober.), *Leucapamea ascondis* (Ober.), *Chaxminodes atrata* (Btl.), **Plusilla rosalia* Stgr., *Callopietria albolineola* (Graes.), *C. repleta* Wlk., **Prometopus flavicollis* (Leech), *Sphragifera biplage* (Wlk.), *Hyposada brunnea* (Leech), *Sinocharis korbae* Pöngl., *Anadevidia hebetata* (Btl.), *Catocala streckeri* Stgr., **C. bella* Btl., *Hypocala subsatura* Gn., **Chrysorithrum flavomaculatum* (Brem.), **Lygephila maxima* (Brem.).

Pieridae : *Gonepteryx rhamni* (L.).

Lycaenidae : **Ussuriana micahaelis* (Ober.), **Japonica saepistriata* (Hewitson).

Hesperiidae : **Bibasis aquilina* (Speyer).

5). Montane larch-spruce taiga : Samjiyon, Mt. Paektu-san

Psychidae : **Sterrhopteryx standfussi* (Wck.).

Adelidae : **Nematopogon magna* (Z.).

Ethmiidae : **Ethmia nigripedilla* (Ersch.)

Gelechiidae : **Chionodes viduella* (F.), **Lita sexpunctella* (F.).

Tortricidae : **Cochylis hybridella* (Hb.), **Christoneura lapponana* (Tgstr.), **Aphelia septentrionalis* Obr., **Croesia bergmanniana* (L.), **Acleris laterana* (F.), **Hedya ochroleucana* (Föl.), **Apotomis betuletana* (Hw.), **Olethreutes turfosa* (H.S.), **O. metallicana* (Hb.), **O. bidentata* Kuzn., **O. bipunctana* (F.), **O. rivulana* (Scop.), **O. metallicana* (Hb.), **O. bidentata* Kuzn., **O. bipunctana* (F.), **O. rivulana* (Scop.), **O. mlediana* (L.), **Rudisociaria expeditana* Snell., **Lobesia duplicata* Flkv.,

**Ancylis uncella* (D. & S.), **A. unguicella* (L.), **A. mytillana* (Tr.), **Epinotia piceae* (Issiki), **Cydia milleniana* (Adamcz.).

Choreutidae : **Prochoreutis solaris* (Ersch.).

Pyralidae : **Agriphila straminella* (D. & S.), **Crambus pascuella* (L.), **C. issiki* Mats., **Chrysoteuchia pyraustoides* (Erschoff), **Pediasia truncatella* (Zett.), **U. hamalis* (Thnbg.).

Pterophoridae : **Stenoptilia nolckeni* (Tgstr.), **Gillmeria pallidactyla* (Hw.).

Thyatiridae : **Habrosyne intermedia* (Brem.).

Geometridae : **Odezia atrata* (L.), **Baptria tribiale* (Esp.), **Xanthorhoe abraxina* (Btl.), **Thera serraria* (Z.), **Electrophaes corylata* (Thnbg.), **Mesoleuca albicillata* (L.), **Rheumaptera hatsta* (L.), **Venusia cambrica* Curt., **Perizoma sagittata* (F.), **Semiothisa brunneata* (Thnbg.), **Odontopera bidentata* (Cl.), **Apeira syringaria* (L.).

Lasiocampidae : **Dendrolimus superans* (Btl.).

Sphingidae : **Laothoe amurensis* (Stgr.), **Smerinthus caecus* Mén.

Notodontidae : **Leucodonta bicoloria* (D. & S.).

Arctiidae : **Parasemia plantaginis* (L.).

Noctuidae : **Trichosea ludifica* L., **Spaelotis suecica* (Auriv.), **Noctua chardinyi* (Bsd.), **Paradiarsia punicea* (Hb.), **Anaplectoides prasina* (D. & S.), **A. virens* (Btl.), **Eurois occulta* (L.), **Diarsia brunnea* (D. & S.), **Xestia sincera* (H. S.), **X. speciosa* (Hb.), **Polia hepatica* (Cl.), **P. goliath* (Ober.), **P. malchani* (Püngl.), **Papestra biren* (Gze.), **Mythimna grandis* Btl., **Callierges ramosula* (Stgr.), **Feralia sauberi* (Graes.), **Blepharita bathensis* (Lutza), **Hyppa rectilinea* (Esp.), **Deltote uncula* (Dl.), **Autographa bruaetica* (Stgr.), **Syngrapha ani* (Hochenw.), **S. interoogationis* (L.), **Euclidia dentata* Stgr., **Callistege mi* (Cl.).

Papilionidae : **Parnassius bremeri* Brem.

Pieridae : **Colias paleno* (L.), **C. heos* (Herbst).

Lycanidae : **Vacciniina optilete* (Knoch).

Nymphalidae : **Hypodryas intermedia* (Mén.), **Boloria titania* (Esp.).

Satyridae : **Eribia embla* (Thnbg.), **Erebia cyclopius* (Ev.), **Oeneis urda* (EV.), **O. jutta* (Hb.), **O. magna* Graes.

Hesperiidae : **Carterocephalus palaemon* (Pallas).

6). Species distributed in all investigated oak-forest ecosystems (Okryu valley, Pagon-pokpo, Mt. Ryongak-san, Hyangsan).

Tortricidae : **Archips asiatica* (Wlsm.), **Hoshinoa longicellana* (Wlsm.), **H. adumbratana* (Wlsm.), **Gnorismoneura hoshinoi* (Kawabe), **Acleris takeuchii* Raz. & Yas., **Hedya inornata* (Wlsm.), **Epinotia rubiginosana* (H. S.).

Pyralidae : **Flavocrambus picassensis* Blesz.

Cyclididae : **Cyclidia substigmatica* (Hb.).

Drepanidae : **Agnidra scabiosa* (Btl.).

Geometridae : **Grandaritis fixseni* (Brem.), **Cystidia stratonice* (Stoll), **Rikiosatoa grisea* (Btl.),

Hypomecis punctinalis (Scop.).

Saturniidae : *Samia cynthia* (Drury), *Actias gnoma* (Btl.).

Sphingidae : *Theretra japonica* (Bsdv.), *Marumba gaschkewitschii* (Br. & Gr.).

Notodontidae : *Phalera grotei* Moore, *Spatalia dives* Ober., *S. doerriesi* Graes.

Nolidae : *Meganola fumosa* (Btl.).

Noctuidae : *Niphonyx segregata* (Btl.), *Sphragifera biplaga* (Wlk.), *Maliattha signifera* (Wlk.), *M. bella* (Stgr.), *Neustrotia noloides* (Btl.), *Aventiola pusilla* (Btl.), *Hyperstrotia flavipuncta* (Leech), *Naranga aenescens* Moore, *Macdunnoughia purissima* (Btl.), *Catocala agitatrix* Graes., *Lagoptera juno* (Dalman), *Chrysorithrum amatum* (Br. & Gr.), *Edessena hamada* (Feld. & Rogen.), *Hedenia incongruens* (Btl.).

Papilionidae : *Sericanus montela* Grey, *Atrophaneura alcinous* (Klug), *Papilio xuthus* L., *P. bianor* Cramer.

Pieridae : *Pieris canidia* Sparrman.

Nymphalidae : *Limnitis helmanii* Led., *Neptis alwina* (Br. & Gr.), *N. pryri* Btl., *Kaniska canace* (L.).

7). Species distributed in all investigated ecosystems (Okryu valley, Pagyon-Pokpo, Mt. Ryongak-san, Mt. Hyang-san and Samjyon)

Tortricidae : *Pandemis cinnamomeana* (Tr.), *P. heparana* (D. & S.), *Archips oporana* (L.), *Choristonerua luticostana* (Chr.), *Clepsis rurinana* (L.), *Ptycholomoides aeriferana* (H. S.), *Celypha cespitana* (Hb.), *Olethreutes siderana* (Tr.), *O. captiosana* (Flkv.).

Pyrilidae : *Catoptria permiaca* (Pet.).

Thyatiridae : *Thyatira batis* (L.).

Geometridae : *Gemetra papilionaria* (L.), *Lobophora halterata* (Hfn.), *Orthonama obstipata* (F.), *Abraxas grossulariata* (L.), *Lomographa temerata* (D. & S.), *Semiothisa liturata* (Cl.), *Arichanna melanaria* (L.), *Angerona prunaria* (L.), *Pladodis pulveraria* (L.), *Petrophora chlorosata* (Scop.).

Lasiocampidae : *Gastropacha orientalis* Sheljuzhko, *Malacosoma neustria* (L.).

Sphingidae : *Callambulyx tatarinovi* (Br. & Gr.).

Arctiidae : *Pericallia matronula* (L.).

Noctuidae : *Euxoa sibirica* (Bsd.), *Agrotis ipsilon* (Hfn.), *Ochroplerua praecurrens* (Stgr.), *O. plecta* (L.), *Diarsia canescens* (Btl.), *Xestia c-nigrum* (L.), *Pseudaletia separata* (Wlk.), *Axylia putris* (L.), *Hadjina chinensis* (Wall.), *Earias pudicana* (Stgr.).

Papilionidae : *Parnassius stubbendorffii* Mén., *Luehdorifa puziloi* (Ersch.), *Papilio machaon* L., *P. maackii* Mén.

Pieridae : *Colias erate* (Esp.), *Anthocharis scolymus* Btl., *Pieris rapae* (L.).

Lycaenidae : *Callophrys frivaldszki* (Led.).

Nymphalidae : *Neptis sappho* (Pallas).

Satyridae : *Pararge achine* (Scop.), *Erebia wanga* Brem.

2. Newly recorded species from Korean peninsula

Adelidae :

Nematopogon magna (Zeller, 1878)

Material examined. 3♂, Samjiyon, 21–22.VI.1988.

Boreo-montane transpalearctic species, the first recorded from East Palearctic was published by Nielsen (1985) from Siberia.

Oecophoridae :

Casmara agronoma Meyrick, 1931

Material examined, 4♂, 1♀ Mt. Kumgang-san : Okryu valley, 19–22.VII.1990.

The species also has been known from China (Clarke, 1963).

Ethmiidae :

Ethmia nigripedella (Erschoff, 1877)

Material examined : 1♂, Samjiyon, 21–22. VI. 1988.

This species is distributed from South-East Europe (Krym) to Primorye territory and Japan (Zagulajev, 1981).

Gelechiidae :

Chionodes viduella (Fabricius, 1794)

Material examined. 6♂, 1♀, Samjiyon, 15–22. VI.1988 : 1♂ Mt. Paektu-san, 13.VII.1987; 1♂ , 1♀., Mt. Paektu-san, 26.VI.1988; 4♂, 4♀, Mt. Kumgang-san : Manmulsang, 24–26.V.1988.

Holarctic species, in West Palearctic closely associated with peatlands (Mikkola & Spitzer, 1983).

Lita sexpunctella (Fabricius, 1794) (= *virgella* Thnbg.)

Material examined. 20♂, 7♀, Samjiyon, 15–21.VI.1988; 6♂, 3♀, Mt. Paektu-san , 26.VI.1988.

Holarctic species.

Tortricidae :

Stenodes triangulifera Kuznetsov, 1966

Material examined. 1♂, Mt. Myohyang-san : Hyangsan, 15.VI.1985.

Manchurian species, Known from Primorye territory and North-East China (Kuznetsov, 1973).

Cochylis hybridella (Hübner, 1813)

Material examined. 2♂, 1♀, Samjiyon, 14.VII.1987.

Transpalearctic species, widely distributed, but predominately in grassland habitats (Kuznetsov, 1973),.

Choristonerua lapponana (Tengström, 1869)

Material examined, 4♂, Samjiyon, 15. & 27.VI.1988.

Holarctic species, distributed in northern tundra and taiga, in the South-East Palearctic known

from Amur region (Kuzetsov, 1973; Kuznetsov & Mikkola, 1991).

Aphelia septentrionalis Obraztsov, 1959

Material examined. 10♂, 1♀, Samjiyon, 12–16.VII.1987; 1♂, 1♀, Mupo, 14.VII.1987; 5♂, 1♀, Mt. Sobek-san, 15.VII.1987; 1♂, Samjiyon, reared from larva collected on *Euphorbia* sp. 16.VI.1988.

Probably a Beringian species known from Northwest Siberia, Japan and Alaska (Razowski, 1981; Kuznetsov & Mikkola, 1991).

Clepsis plumbeolana (Bremer, 1864)

Material examined. 11♂, 4♀, Samjiyon, 12–16.VII.1987; 5♂, 1♀, specimens, Mupo, 14.VII.1987; 11♂, 12♀, Mt. Sobek-san, 15.VII.1987; 2♂, 1♀, Samjiyon, reared from larvae collected on *Pyrola* sp. and *Rubus* sp. 17–25.VI.1988.

The species was previously known from Amur region, Primorye territory and China (Kuznetsov, 1973; Razowski, 1979).

Clepsis helvolana (Frolich, 1828)

Material examined. 2♂, 3♀, Samjiyon, 16–21.VI.1988.

Transpalearctic species, in the South-East Palearctic known from Amur region and Primorye Territory (Kuznetsov, 1973).

Homonopsis illotana (Kennel, 1901)

Material examined. 1♂, Mt. Myohyang-san, Hyangsan, 26.VI.1987; 2♂, 1♀, Mt. Myohyang-san, Hyangsan, 12–15.VII.1990.

Previously known from Japan, Primorye territory and China (Kuznetsov, 1973).

Ptycholoma micantana (Kennel, 1901)

Material examined. 1♂, Mt. Myohyang-san, Hyangsan, 15.VI.1985; 7♂, 15♀, Mt. Myohyang-san, Mt. Hyangsan, 25–26.VI.1987; 1♂, Mt. Myohyang-san, Hyangsan, 14.VII.1990; 1♀, Hamhung env., Mt. Paegun-san, 29.VI.1988.

Manchurian species known from Amur region, Primorye territory and China (Kuznetsov, 1983).

Cnephasia ussurica Filipiev, 1962

Material examined. 3♂, 1♀, Mt. Kumgang-san, Okryu valley, 18–19.V.1988; 1♀, Mt. Kumgang-san, Onjongri, 20.V.1988.

Previously known only from Primorye territory : South Sichote-Alin (Kuzetsov, 1973).

Acleris japonica (Walsingham, 1900)

Material examined. 2♂, Kaesong, Pogyon-pokpo, 2.VII.1987.

Previously known only from Japan : Honshu, Kyushu (Razowski, 1984).

Croesia bergmanniana (Linnaeus, 1758)

Material examined. 4♂, 3♀. Samjiyon, reared from larvae collected on *Rosa* sp. 16.VI.1988.

Transpalaeartic species, in Japan is replaced by closely related species *C. elegans* (Oku) (Razowski, 1984).

Hedya perspicuana (Kennel, 1901)

Material examined. 2♂, Mt. Kumgang-san, Okryu valley, 5 & 8.VI.1987.

Manchurian species, previously known from Primorye territory and North-East China (Kuznetsov, 1973).

Hedya semiassana (Kennel, 1901)

Material examined. 3♂, Mt. Myohyang-san, Hyangsan, 25.VI.1987.

Known from Japan, Primorye territory and Amur region (Kuznetsov, 1973).

Hedya ochroleucana (Frölich, 1828)

Material examines. 1♂, 1♀, Samjiyon, 13.VII.1987; 7♂ 2♀, Mt. Sobek-san, 15.VII.1987; 1♂, Hyesan, 11.VII.1987; 2♂, 1♀, Hoeryong, 17.VI.1987; 1♂, Samjiyon, reared from larva collected on *Rosa* sp. 16.VI.1988.

Widely distributed Holarctic species (Kuznetsov, 1973).

Apotomis betuletana (Haworth, 1811)

Material examined. 4♂, Samjiyon, reared from larvae collected on *Betula* sp. 15.VI.1988.

Transpalaeartic species (Kuznetsov, 1973).

Olethreutes trufosana (Herrich-Schäffer, 1851)

Material examined. 1♂, Samjiyon, 12.VII.1987; 14♂, 2♀, Samjiyon, 16-27.VI.1988; 2♂, Mt. Paektu-san, 26.VI.1988; 1♂, Mupo, 23.VI.1988.

Transpalaeartic species (Kuznetsov, 1973). specimens collected from Mt. Paektu-san are distinguished from European specimens by their considerable larger size, as well as all specimens from East Palaearctic (cf. Kuznetsov, 1973). The species is associated with peat bogs in central and northern Europe (Mikkola & Spitzer, 1983). East palaeartic population are associated also with some forest ecosystems (Kuznetsov, 1973; Kuznetsov & Mikkola, 1991).

Olethreutes metallicana (Hübner, 1799)

Material examined. 17♂, 4♀, Samjiyon, 12-16.VII.1987; 3♂, Samjiyon, 25-27.VI.1988; 6♂, 1♀, Mt. Paektu-san, 13.VII.1987; 3♂, Mupo, 14.VII.1987; 3♂, Mupo, 24.VI.1988; 5♂, 2♀, Mt. Sobek-san, 15.VII.1987; 1♂, Naegokri, 18.VI.1988; 6♂, Taehongdan, 23.VI.1988.

Transpalaeartic species with boreo-montane distribution, associated with montane tundra and taiga, populations from Primorye Territory are associated also with lowland deciduous forests (Kuznetsov, 1973).

Olethreutes bidentata Kuznetsov, 1971

Material examined. 1♂, Samjiyon, 13.VII.1987; 4♂, Samjiyon, 21-25.VI.1988; 1♂, Mupo, 24.VI.1988.

Previously known only from the type locality in Amur region (Kuznetsov, 1971). In Mt. Paektu-san associated with montane taiga.

Olethreutes bipunctana (Fabricius, 1794)

Material examined. 7♂, 3♀, Samjiyon, 12-16.VII.1987; 6♂, 1♀, Mt. Paektu-san, 13.VII.1987; 4♂, Mupo, 14.VII.1987; 4♂, 5♀, Mt. Sobek-san, 15.VI.1987; 1♂, Hyesan, 11.VII.1987

A transpalaeartic species, not conspecific with closely related to *O. glaciana* (Möschler, 1860), recently recorded from North-East Siberia (cf. Kuznetsov & Mikkola, 1991).

Olethreutes rivulana (Scopoli, 1763)

Material examined. 40♂, 4♀, Samjiyon, 12-16.VII.1987; 1♂, Mupo, 14.VII.1987; 15♂, 3♀, Mt. Sobek-san, 15.VII.1987.

Transpalaeartic species, common in the Amur region, southern Primorye territory, Japan and southern Korea replaced by closely related *O. Pryerana* Wlsm. (Kuznetsov, 1973; Park & Park, 1988).

Olethreutes lediana (Linnaeus, 1758)

Material examined. 36♂, 17♀, Samjiyon, 15-25.VI.1988.

Transpalaeartic species, associated with *Ledum palustre* L. (Kuznetsov, 1973).

Rudisociaria expidetana Snellen, 1883

Material examined : 14♂, 3♀, Samjiyon, 17-27.VI.1987; 1♂, Mt. Paeksu-san, 13.VII.1987.

East Palaearctic species, distributed from Ural Mts. to the Amur region (Kuznetsov, 1973).

Lobesia duplicata Falkovitsh, 1970

Material examined. 1♂, Samjiyon, 14.VII.1987; 1♂, 1♀, Samjiyon, 21-22.VI.1988; 3♂, 4♀, Mupo, 23-24.VI.1988.

East Palaearctic species distributed from Irkutsk to Primorye territory (Kuznetsov, 1973).

Ancylis uncella (Denis & Schiffermüller, 1775)

Material examined. 10♂, 3♀, Samjiyon, 15-21.VI.1988; 6♂, 8♀, Mupo, 23.VI.1988.

Transpalaeartic species, in Primorye Territory and Amur region associated with various types of forests and peatlands (Kuznetsov, 1973).

Ancylis unguicella (Linnaeus, 1758)

Material examined. 1♂, Samjiyon, 16.VII.1987; 15♂, 9♀, Samjiyon, 15-25.VI.1988; 1♂, Mt. Paektu-san, 26.VI.1988.

Holarctic species, in East Palaearctic region previously known only from Amur region (Kuznetsov, 1973).

Ancylis myrtillana (Treitschke, 1830)

Material examined. 2♂, 4♀, Samjiyon, 12-16.VII.1987; 54♂, 12♀, Samjiyon, 15-27.VI.1988; 2♀, 14.VII.1987; 9♂, 2♀, Mupo, 23-24.VI.1988; 1♂, 3♀, Mt. Paektu-san, 13.VII.1987; 2♂, 4♀, Mt. Paektu-san, 26.VI.1988; 2♂, 1♀, Taehongdan, 23.VI.1988.

Transpalaearctic species (Kuznetsov, 1973).

Epinotia piceae (Issiki, 1961)

Material examined. 3♂, 3♀, Samjiyon, 13.VII.1985; 1♀, Samjiyon, 15.VII.1987.

East Palaearctic species previously known from Primorye territory, Sakhalin, Kurily Islands and Japan (Kuznetsov, 1976).

Cydia milleniana (Adamczewski, 1967)

Material examined. 1♂, Mupo, 23.VI.1988.

Transpalaearctic species associated with *Larix* spp. In East Palaearctic region previously known only from Amur region (Kuznetsov, 1986).

Choreutidae :

Prochoreutis solaris (Erschoff, 1877)

Material examined. 3♂, Samjiyon, 14.VII.1987; 1♂, Mt. Sobek-san, 15.VII.1987.

Probably East Palaearctic species (Diakonoff, 1986).

Pyralidae :

Euchromius expansus (Butler, 1881)

Material examined. 2♂, 13♀, Mt. Ryongak-san, 10.VII.1990; 1♀, Mt. Ryongak-san, 28.VII.1990; 2♀, Mt. Myohyang-san, Hyang-san, 14.VII.1990.

Manchurian species, previously known from Amur region and China (Bleszynski, 1965a).

Agriphila straminella (Denis & Schiffermüller, 1775)

Material examined. 2♂, Samjiyon, 16.VII.1987.

Widely distributed Holarctic species (Bleszynski, 1965a).

Crambus isshiki Matsumura, 1925

Material examined : 1♂, Samjiyon, 12.VII.1987; 3♂, Samjiyon, 20-27.VI.1988; 2♂, Mupo, 24.VI.1988.

Manchurian species, previously known from Primorye territory, Amur region, Sakhalin and Manchuria (Bleszynski, 1965a).

Crambus pseudargyrophorus Okano, 1960

Material examined. 2♂, 1♀, Mt. Kumgang-san, Okryu valley, 19-22.VII.1990; 2♀, Mt. Kumgang-san, Onjongri, 18.VII.1990; 1♂, Mt. Myohyang-san, Hyangsan, 13.VII.1990.

Previously known from Japan, North China, Amur region and Primorye territory (Bleszynski, 1965a). This species most closely resembles superficially *C. argyrophorus* Btl., but can be reliably distinguished from the latter by examination of the genitalia. *C. argyrophorus* was published from southern Korea by Park., (1983). Bleszynski (1965a) supposed that *C. argyrophorus* is endemic to Japan only. In our material from northern Korea we found *C. pseudargyrophorus* only.

Chrysoteuchia pyraustoides (Erschoff, 1877)

Material examined. 1♀, Samjiyon, 21.VI.1988.

This species is distributed from Central Asia to Amur region and China (Bleszynski, 1965a). This species resembles superficially some species belonging to the genus *Ethmia* such as *E. nigripidella* Ersch.

Flavocrambus picassensis Bleszynski, 1965

Material examined: 1♂, Mt. Kumgang-san, Okryu valley, 22.VII.1990; 1♂, Mt. Kumgang-san, Onjongri, 18.VII.1990; 1 specimen, Mt. Kumgang-san, Manmulsang, 21.VII.1990; 3♂, 1♀, Kaesong: Pagon Pokpo, 3.VIII.1990; 6♂, 1♀, Mt. Ryongak-san 10.VII.1990; 3♂, 1♀, Mt. Ryongak-san, 28.VII.1990; 1♂, Mt. Myohyang-san, Hyangsan, 26.VI.1987; 2♂, Hyangsan, 13-14.VII.1990; 1♂, Mt. Myohyang-san, Pirobong valley, 12.VII.1990; 1♂, Mt. Myohyang-san, Sogok falls, 13.VII.1990.

This species is distributed from Ural Mts. to Primorye territory. Bleszynski (1965a) described *F. picassensis* as a new species, which is distinguished from the closely related species *F. striatellus* (Leech), by the characters of male and female genitalia, and we suggest that previously reported *F. striatellus* from Korea needs a further study for the confirmation. Our data confirm only the record of *F. picassensis* from North Korea.

Pediasia truncatella (Zetterstedt, 1840)

Material examined. 2♀, Mupo, 24.VI.1988, wet peaty soils of open larch taiga near Samjiyon, about 1400 m alt.

Holarctic (boreal) species. A record from the adjacent country, was Amur region by Bleszynski (1965a) as *P. altaica* (Stgr.), which has been known as a synonym of *P. truncatella*. Review of distribution and ecology of *P. truncatella* was previously given by Spitzer (1988). The species is associated with peat bogs and peaty soils.

Geometridae :

Thera serraria (Zeller, 1846)

Material examined. 2♂, Samjiyon, 14-15.VII.1987; 1♂, Samjiyon, 27.VI.1988; 1♂, Mt. Paektu-san, 13.VII.1987; 1♂, Samjiyon, 27.VI.1988; 1♂, Mt. Paektu-san, 13.VII.1987.

Transpalearctic species, distributed from Scandinavia to Primorye territory (Bleszynski, 1965b).

Eletrophaes corylate (Thunberg, 1792)

Material examined. 1 ♀, Mt. Kumgang-san, Onjongri, 2.VI.1987; 2 ♂, 1 ♀, Samjiyon, 14–23.VI.1988; 1 ♂, Taehongdan, 23.VI.1988; 2 ♀, Mt. Paektu-san, 26.VI.1988; 2 ♂, 1 ♀, Hyesan, 11.VII.1987; 1 ♂, 5 ♀, Mt. Hyesan, 27.VI.1988; 2 ♀, Hoeryong, 17.VI.1987; 1 ♂, Puryong, 17.VI.1987.

Transpalaeartic species (Bleszynski, 1965b).

Notodontidae :*Dicranura tsvetaevi* Schintlmeister & Sviridov, 1985

Material examined. 1 ♂, Mt. Kumgang-san, Onjongri, 18.V.1988.

Previously known from Primorye territory (Schintlmeister et al., 1987). This species is a vicarious species of West Palaeartic species *D. ulmi* (D. & S.).

Hagapteryx kishidai Nakamura, 1978

Material examined. 2 ♂, Mt. Myohyang-san, Hyangsan, 26.VI.1987; 1 ♂, Mt. Myohyang-san, Hyangsan, 13. VII. 1990.

East Palearctic species, previously known from Amur region, Primorye territory, China and Japan only (Schintlmeister et al., 1987).

Nerice leechi Staudinger, 1892

Material examined. 1 ♂, Mt. Kumgang-san, Okryu Valley, 19.VII.1990.

East Palaeartic species, previously recorded from Amur region, Primorye territory and Sakhalin (Schintlmeister et al., 1987).

Noctuidae :*Xestia sincera* (Herrich-Schäffer, 1851)

Material examined. 2 ♂, Samjiyon, 14.VII.1987.

A Palaeartic species associated with waterlogged spruce forests, which its distribution is little known in East Palaeartic and recorded from Primorye territory by Kononenko (1990).

Xestia speciosa (Hübner, 1813)

Material examined. 3 ♂, Mt. Sobaek-san, VIII.1989—H. G. Cho leg.

A Holarctic boreo-montane species, recorded also from various localities in East Palaeartic (Inoue et al., 1982; Kononenko, 1986, 1990).

Polia malchani (Püngeler, 1914)

Material examined. 2 ♂, Samjiyon, 28.VI.1988.

A Siberian species (Kononenko, 1989; Kononenko & Spitzer, in prep.) associated with montane and northern taiga. The Paektusan population seem to be the most southern occurrence.

Feralia sauberi (Graeser, 1892)

Material examined. 4 ♀, Samjiyon, 28.VI.1986—M. Tonner leg.; 47 ♂, 8 ♀, Samjiyon, 14—23.VI.1988.

A montane East Palaearctic species (Kononenko, 1986), record also from Japan (Sugi, 1972) as *F. montana* (see Kononenko, 1990). Larvae feed on *Larix* (Sugi, 1972; Nakamura, 1984).

Callierges ramosula (Staudinger, 1888)

Material examined. 4 ♂, Samjiyon, 14.VI.1988.

East Siberian species, characteristic for some types of taiga (Kononenko, 1986, 1990).

Autographa buraetica (Staudinger, 1892)

Material examined 12 ♂, 3 ♀, Samjiyon, 12—16.VII.1987; 1 ♂, Samjiyon, 23.VI.1988; 1 ♂, 1 ♀, Mt. Hyesan, 11.VII.1987.

Siberian species, recorded recently also from Europe. In East Palaearctic probably widely distributed (Inoue et al., 1982; Kononenko, 1989, 1990; Kerppola & Mikkola, 1987). The species was not safely recorded from Korea (cf. Ronkay, 1982).

DISCUSSION AND CONCLUSIONS

The present synecological review provides a basic biogeographical outline of the Korean lepidoptera. It is clear that the northern Montane part of Korea is closely connected to the Siberian biogeographical province (cf. Bryk, 1947; Kurentzov, 1965, 1970; Kostrowicki, 1969). Kurentzov (1965) proposed a more detailed zoogeographical division of eastern Siberia. Dominant Species in the characteristic Palaearctic-Eurosiberian region are *Choristonerua lapponana* (Tgstr.), *Olethreutes turfosa* (H. S.), *O. lediana* (L.), *Thera serraria* (Z.), *Xestia sincera* (H. S.), *Syngrapha ain* (Hochenw.) and *Erebia embla* (Thnbg.), and main Siberian taxa are *Rudisociaria expeditana* (Snell), *Polia malchani* (Prügl.) and *Oeneis magna* Graes. The Holarctic faunal component is also present with species *Aphelia septentrionalis* Obr., *Pediasia truncatella* (Zett.), *Xestia speciosa* (Hb.), *Papestra biren* (Gze.), *Syngrapha interrogationis* (L.), *Colias palaeno* (L.), *Vacciniina optilete* (Knoch) and *Boloria titania* (Esp.). Several endemic subalpine species in East Palaearctic mountains only are *Frealia sauberi* (Graes.), *Clepsia plumbeolana* (Brem.), *Epinotia piceae* (Issiki) and *Parnassius bremeri* Brem. The predominant part of northern Korea is covered by diverse deciduous, mostly oak forests with typical East Palaearctic species (e. g. *Spatalistis christophana* (Wlsm.), *Gnorismoneura hoshinoi* (Kawabe), *Monema flavescens* Wlk., *Latoia sinica* (Moore), *Strigina cancellata* (Christ.), *Cyclidia substigmata* (Hb.), *Marumba gaschkewitschii* (Br. & Gr.), *Dudusa sphingiformis* Moore, *Spatalia doerriesi* Graes., *Sineugraphe disgnosta* (Brsn), *Amphipyra schrenckii* Men., and *Cosmia camptostigma* (Mén.). But within the large oak zone some very local and characteristic taxa are present (namely in the Sasamorpha-oak forest habitats—*Brahmaea certhia* (F.), *B. tancrei* Aust. *Marumba maackii* (Brem.), *Numenes disparilis* Stgr., *N. albofascia* (Leech), *Amphipyra erebina* Btl. and *Lethe diana*

(Btl.). Perhaps the Sasamorpha forest communities in Japan seem to be similar or analogous, but a further comparative studies are badly needed (cf. Hämet-Ahti, Ahti & Koponen, 1974). No strictly endemic species are recorded (see also Bryk, 1947, Kurentzov, 1965). Stebnicka (1979) reached similar conclusions based on studies of Korean Scarabeidae (Coleoptera). Highly interesting local community of the Sasamorpha oak forests seems to be unique and typical for Korea. Species of subtropical and tropical oriental origin are not characteristic faunal components, but many of them are tropical migrants (e. g. *Lagoptera jono* (Dalm.), *Pseudaletia separata* (Wlk.), *Hypocala subsatura* Gn. and *Kanisca canace* (L.)) which are not closely associated with particular Korean habitats. Widely distributed Oriental species, probably non-migratory, are also represented in Korean fauna, (*Samia cynthia* (Drury), *Phalera grotei* Moore, *Trichosea champa* (Moore), *Macdunnoughia purissima* (Btl.), *Arcte coerulea* (Gn.) and *Pieris canidia* Sparr). Presence of other Oriental insects in Korea is also documented by Kurentzov (1965) and Stebnicka (1979). Several species which are recorded for the first time from Korea are associated mostly with the montane zone and these new records are predominantly Siberian and northern East Palaearctic faunal components.

ACKNOWLEDGMENTS

Authors thank to Dr. J. Lep. for his field assistance and plant ecological data, and to Dr. V. S. Kononenko for his helpful discussions. The field studies were financially supported by the Czechoslovakia Academy of Sciences.

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북한지역 나비목곤충의 생물지리학적 개요

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1) 체코슬로바키아 과학원 곤충연구소

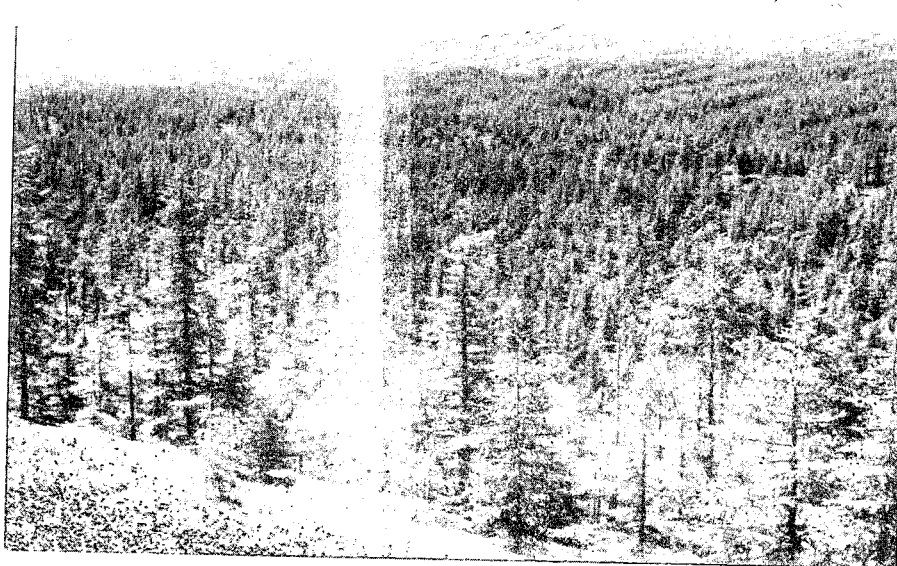
2) 강원대학교 농생물학과

지난 수년동안 북한지역에서의 곤충조사를 통하여 백두산, 묘향산, 용악산, 박연산, 금강산등 주요 5개 지역에 대해 지역별 식물분포와 나비목곤충의 생물지리학적 분포관계를 분석함과 동시에 51종의 한반도 미기록종을 보고한다.

검색어: 나비목, 군집생태, 생물지리학, 분류, 한국.

(Received: May 20, 1992)

1



2



Fig. 1 & 2. Mt. Paektu-san: Montane larch-spruce taiga

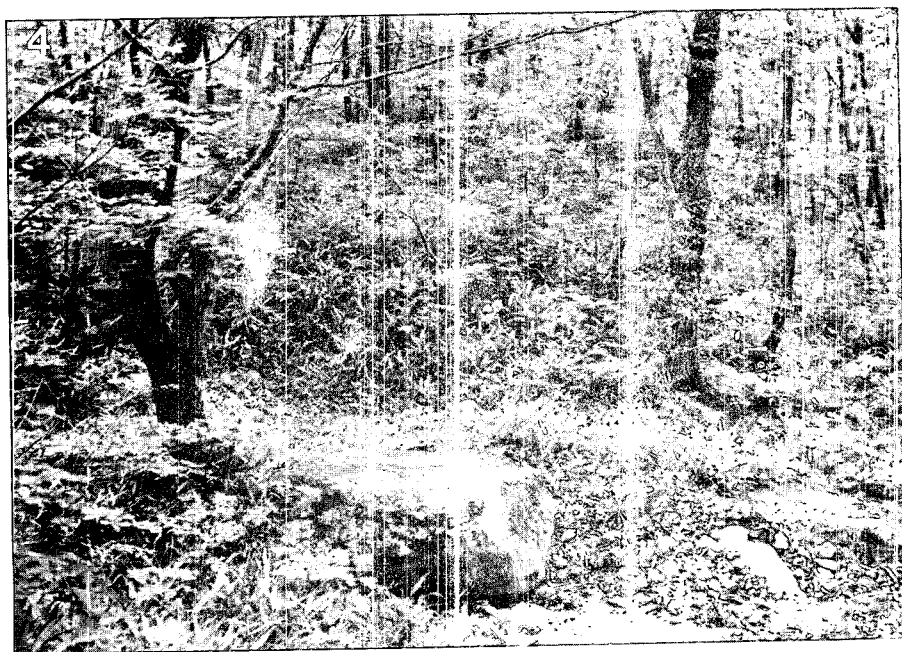


Fig. 3 & 4. Okryu valley, Mt. Kumgang-san: Sasamorpha-oak forest

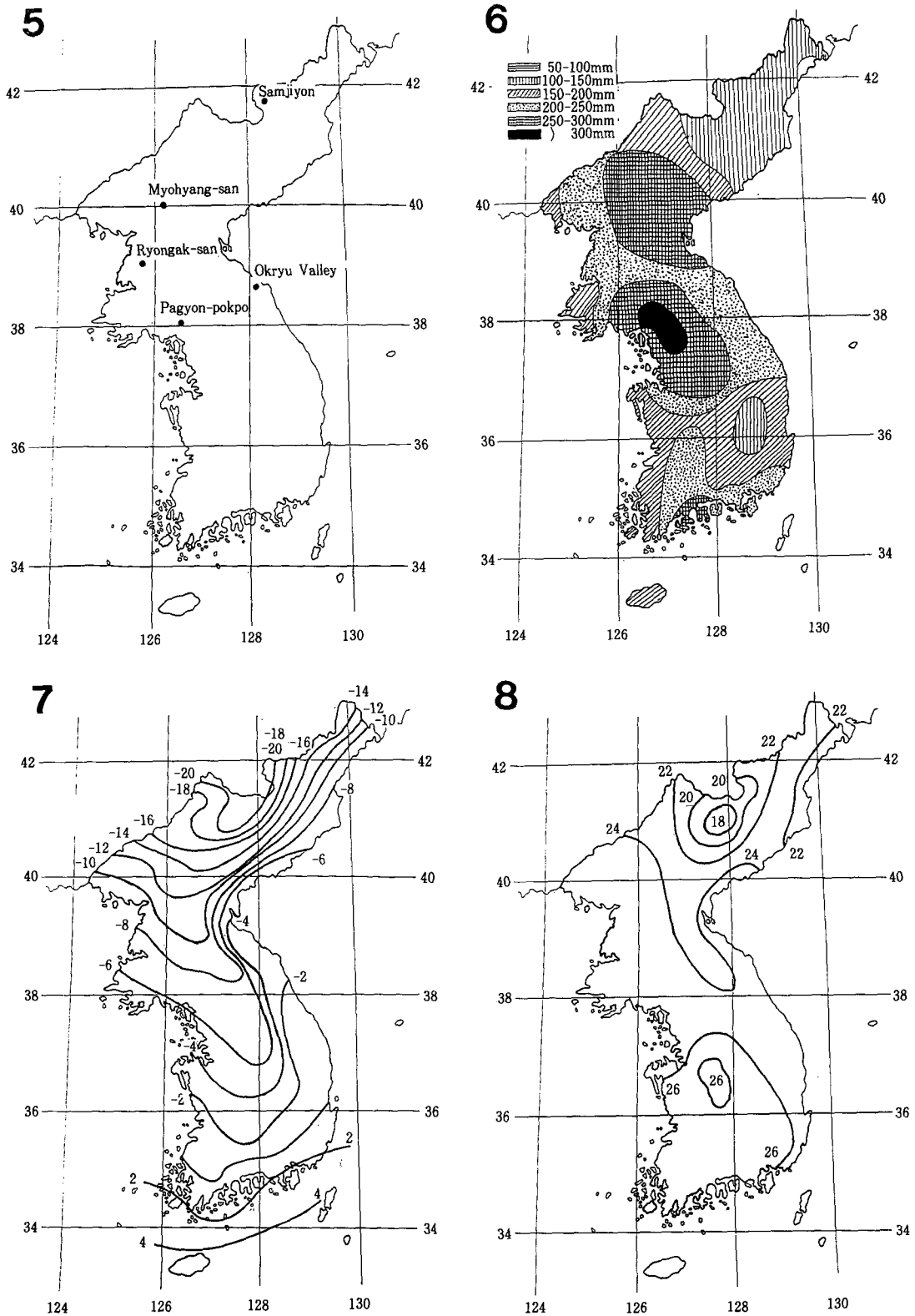


Fig. 5—8. 5, Map of the Korean Peninsula : main collecting localities; 6, Mean long term July precipitation; 7, Mean long term July temperature; 8, Mean long term January temperature.

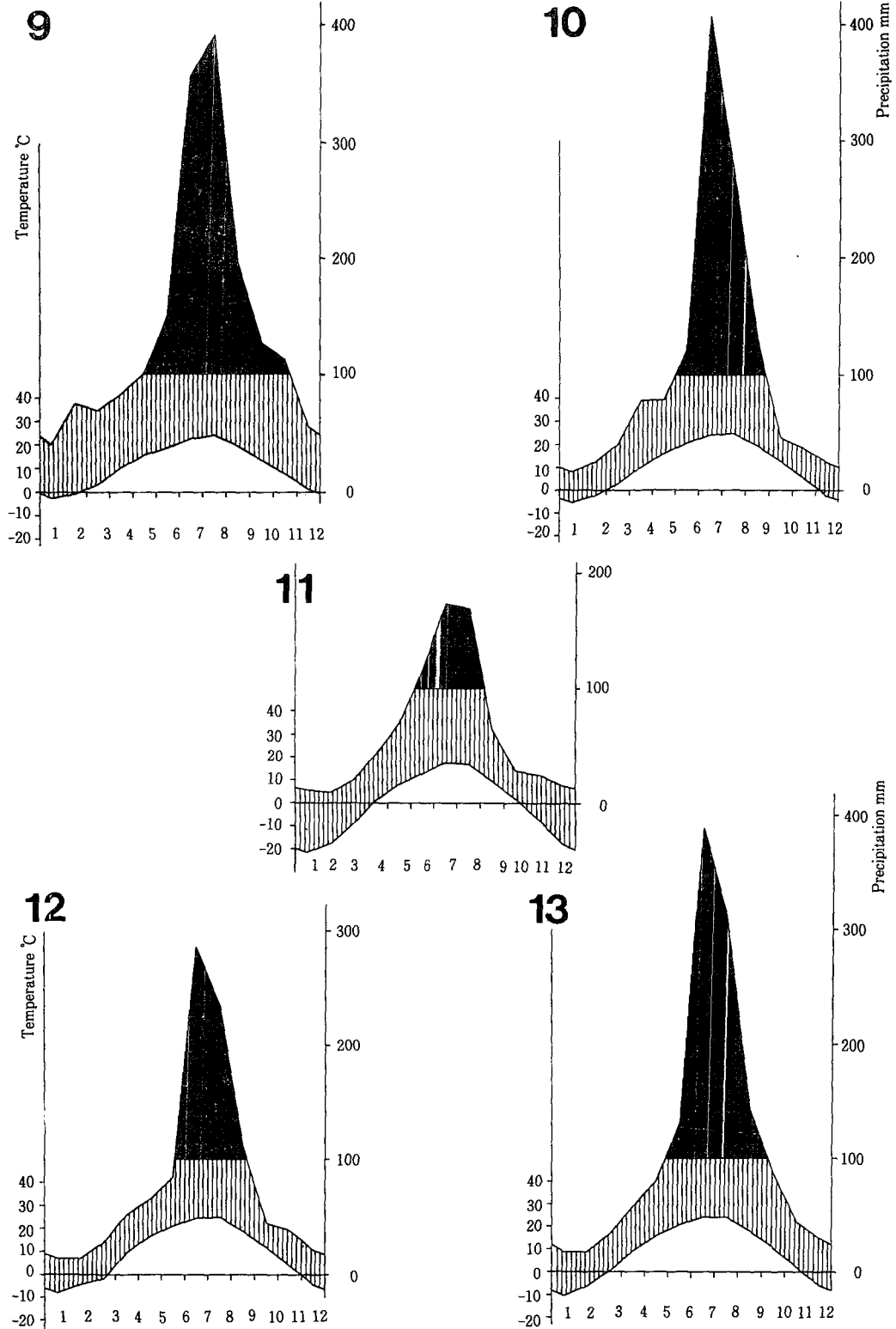


Fig. 9—13. Walter's climatediagram : 9, Okryu-valley(Onjong-ri district, Mt. Kumgang-san); 10, Pagyon-pokpo (Kaesong district); 11, Mt. Ryongak-san (Pyongyang district, Taedong-gang basin); 12, Hyangsan (Mt. Myohyang-san); 13, Samjiyon(Ryanggangdo province, Mt. Paektu-san).